REMARKS

I. STATUS OF THE CLAIMS

Claims 1-4 and 8-19 are currently pending.

II. REJECTION OF CLAIMS 1-4 AND 8-19 UNDER 35 USC 103 AS BEING OBVIOUS OVER DIGIOVANNI (US PATENT NO. 5,406,404) IN VIEW OF NAITO (US PATENT NO. 5,568,310)

In the present invention as recited, for example, in claim 3, an optical transmission system comprises (a) an optical transmitter transmitting a WDM optical signal including a plurality of optical signals with different wavelengths; (b) a multi-stage optical amplifier, having an input and an output, to amplify the WDM optical signal from the optical transmitter received through the input with substantially equal gain over the wavelengths of the optical signals and to output the amplified WDM optical signal from the output; and (c) an optical receiver receiving the amplified WDM optical signal from the multi-stage optical amplifier.

As recited, for example, in claim 3, the multi-stage optical amplifier includes (i) a first-stage optical amplifier, coupled to the input, which amplifies the WDM optical signal, (ii) a level controller which controls a power level of the WDM optical signal amplified by the first-stage optical amplifier, and (iii) a second-stage optical amplifier, coupled to the output, which amplifies the WDM optical signal of which level is controlled by the level controller.

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Therefore, the present invention as recited, for example, in claim 3, specifically recites a multi-stage optical amplifier "to amplify the WDM optical signal ... with substantially equal gain over the wavelengths of the optical signals."

The Examiner asserts that "DiGiovanni discloses a multi-stage optical amplifier (multiple EDFAs #1) for amplifying received WDM signals (fig. 1) with substantially equal gain (fig. 2) ...". However, the applicants respectfully disagree for the reasons indicated below.

More specifically, in DiGiovanni, FIG. 2 shows the gain spectra for a *single* EDFA for varying degrees of gain compression. See, for example, column 2, lines 17-18, of DiGiovanni. FIG. 1b of DiGiovanni discloses the structure of this *single* EDFA. As can be seen from the structure shown in FIG.1b, the *single* EDFA of DiGiovanni is NOT a multi-stage optical amplifier.

More specifically, this single EDFA does NOT include multiple amplification stages.

Therefore, it is respectfully submitted that FIG.2 of DiGiovanni does not show substantially equal gain of a *multi-stage* optical amplifier.

On the other hand, the gain spectra for multiple EDFAs is shown in FIG.5 of DiGiovanni. Column 3, lines 62-68 of DiGiovanni discloses:

> "FIG. 5 shows the output power of the amplified signal after each amplifier, normalized such that the output at the peak wavelength of each amplifier is set to 0 dB. Again, as expected, the difference between the extreme channels and the center channels increases on passing through each amplifier."

Therefore, the normalized output power in FIG. 5 of DiGiovanni simply shows that the difference in output power increases between the extreme channels and the center channels as the number of amplifiers increases.

In view of the above, it is respectfully submitted that DiGiovanni does not disclose a multi-stage optical amplifier with substantially equal gain over wavelengths of the optical signals.

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Further, it is respectfully submitted that DiGiovanni "teaches away" from a multi-stage optical amplifier with substantially equal gain over wavelengths of the optical signals.

More specifically, DiGiovanni is directed to mitigating gain peaks in a chain of fiber amplifiers, by controlling the pump light provided to the amplifiers. See, for example, the Abstract; column 2, lines 29-40, of DiGiovanni.

Column 3, lines 59-68, of DiGiovanni, discloses:

> "In addition to SNR, the variation in gain or output power of the chain of amplifiers with signal wavelength may also be of importance depending upon the dynamic range of the particular receiver used. FIG. 5 shows the output power of the amplified signal after each amplifier, normalized such that the output at the peak wavelength of each amplifier is set to 0 dB. Again, as expected, the difference between the extreme channels and the center channels increases on passing through each amplifier."

Further, column 3, lines 46-50, of DiGiovanni discloses:

"The SNR varies little with wavelength after one amplifier. However, after passing through four amplifiers there is a significant decrease in the SNR at the shortest and longest wavelengths compared to the center."

Therefore, DiGiovanni discloses that

(1) the difference of gain between the extreme channels and the center channels increases on passing through each amplifier; and

(2) there is a significant decrease in the SNR at the shortest and longest wavelengths compared to the center after passing through a plurality of amplifiers.

Accordingly, DiGiovanni suggests the negative impact on the WDM optical signal after passing through a plurality of optical amplifiers dispersed along an optical transmission line. However, DiGiovanni recognizes that, in long haul transmission systems, it is necessary to have a plurality of optical amplifiers dispersed along the optical transmission line. To address the negative impact of the plurality of optical amplifiers, DiGiovanni relates to wavelength of the pumping light of the optical amplifiers.

As DiGiovanni suggests the negative impact on the WDM optical signal after passing through a plurality of optical amplifiers dispersed along an optical transmission line, DiGiovanni can be seen as "teaching away" from employing a multi-stage optical amplifier to amplify a WDM optical signal with substantially equal gain over the wavelengths of the optical signals as recited, for example, in claim 3.

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Please note that the claims specifically recite a "multi-stage" optical amplifier having an "input" and an "output". For example, as shown in FIG. 1 of the present application, a multi-stage optical amplifier is a device having an "input" and an "output", and multiple amplifier stages between the input and the output. Various of the other figures show a device having an "input" and an "output", and multiple amplifier stages between the input and the output. Accordingly, it is respectfully submitted that a multi-stage optical amplifier would be well-known to a person of ordinary skill in the art as being a device having an input and an output, and a plurality of amplifier stages between the input and output.

DiGiovanni discloses a plurality of optical amplifiers which are simply dispersed along a

transmission line. For example, column 4, lines 13-15, of DiGiovanni, indicate that "a chain of fiber amplifiers is interspersed within a communication system". Therefore, the amplifiers of DiGiovanni are positioned at significant distances from each other in a dispersed manner throughout the communication system. It is respectfully submitted that DiGiovanni does not disclose or suggest a "multi-stage" optical amplifier including a first-stage optical amplifier, a level controller and a second stage optical amplifier, as recited, for example, in claim 3. For example, no portion of DiGiovanni discloses a device having an "input" and an "output", with multiple stages between the input and output.

In the Office Action, the Examiner considers one of the dispersed amplifiers in DiGiovanni to be one stage of a multi-stage optical amplifier, and a different dispersed amplifier in DiGiovanni to be another stage of the multi-stage optical amplifier. However, it is respectfully submitted that such interpretation of DiGiovanni would be contrary to the ordinary meaning of a multi-stage optical amplifier as being a device having an input and an output, and a plurality of amplifier stages between the input and output.

Further, as shown in FIG. 5 of DiGiovanni, the output of dispersed amplifiers described in DiGiovanni as a function of signal wavelength is not substantially equal, and thus it is respectfully submitted that DiGiovanni does not disclose a multi-stage optical amplifier with substantially equal gain over the wavelengths of the optical signals.

Therefore, it is respectfully submitted that DiGiovanni does not disclose a multi-stage optical amplifier, as recited in the claims.

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Although the above arguments are specifically directed to claim 3, it is respectfully submitted that the arguments would be helpful in understanding differences in various other claims over DiGiovanni.

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FIG. 1A of DiGiovanni discloses the use of variable attenuators 2. However, the variable attenuators 2 in FIG. 1A of DiGiovanni are used in a substantially different manner than the level controller recited, for example, in claim 3. For example, as indicated in column 3, lines 21-36, of DiGiovanni, variable attenuators 2 are simply used to represent fiber or splitting loss in the test system of FIG. 1A. These attenuators of DiGiovanni are NOT used in a multi-stage optical

amplifier having a first-stage and a second-stage to amplify a WDM optical signal with substantially equal gain over wavelengths as recited, for example, in claim 3.

Further, the attenuators of DiGiovanni are NOT used as variable optical attenuators in the manner recited, for example, in dependent claims 8-11.

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In view of the above, it is respectfully submitted that the rejection is overcome.

III. CONCLUSION

In view of the above, it is respectfully submitted that the application is in condition for allowance, and a Notice of Allowance is earnestly solicited.

If any further fees are required in connection with the filing of this response, please charge such fees to our Deposit Account No. 19-3935.

Respectfully submitted,

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